**Exercise 5: Logic Circuit Design**

**SECTION A**

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| 1. | Logic diagrams and truth tables are equally powerful in expressing the processing of gates and circuits. **(True/False)** |
| 2. | Boolean expressions are more powerful than logic diagrams in expressing the processing of gates and circuits. **(True/False)** |
| 3. | A NOT gate accepts two inputs. |
| 4. | The output value of an AND gate when both inputs are 1 is 1. **(True/False)** |
| 5. | The AND and OR gates produce opposite results for the same input **(True/False)** |
| 6. | The output value of an OR gate when both inputs are 1 is 1. **(True/False)** |
| 7. | The output of an OR gate when one input is 0 and one input is 1 is 0. **(True/False)** |
| 8. | The output value of an XOR gate is 0 unless both inputs are 1. **(True/False)** |
| 9. | The NOR gate produces the opposite results of the XOR gate. **(True/False)** |
| 10. | A gate can be designed to accept more than two inputs. **(True/False)** |
| 11. | A transistor is made of semiconductor material. **(True/False)** |
| 12. | Inverting the output of an AND gate is equivalent to inverting the individual signals first, then passing them through an OR gate. **(True/False)** |
| 13. | The sum of two binary digits (ignoring the carry) is expressed by an AND gate. **(True/False)** |
| 14. | A full adder takes the carry-in value into account. **(True/False)** |
| 15. | A multiplexer adds all of the bits on its input lines to produce its output. **(True/False)** |
| 16. | Integrated circuits are classified by the number of gates contained in them. **(True/False)** |
| 17. | A CPU is an integrated circuit. **(True/False)**  **SECTION B** |

**For Exercises 18 - 29, match the gate with the diagram or description of the operation.**

**A. AND**

**B. NAND**

**C. XOR**

**D. OR**

**E. NOR**

**F. NOT**

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| 18. | Inverts its input. |
| 19. | Produces a 1 only if all its inputs are 1 and a 0 otherwise. |
| 20. | Produces a 0 only if all its inputs are 0 and a 1 otherwise. |
| 21. | Produces a 0 only of its inputs are the same and a 1 otherwise. |
| 22. | Produces a 0 of all its inputs are all 1 and a 1 otherwise. |
| 23. | Produces a 1 if all its inputs are 0 and a 0 otherwise. |
| 24. |  |
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| 29. | **SECTION C** |

**Exercises 30 - 47 are short answer or design questions.**

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| 30. | Distinguish between a gate and a circuit. |
| 31. | What are the three notational methods for describing the behavior of gates and circuits? |
| 32. | Characterize the notations asked for in Exercise 31. |
| 33. | How many input signals can a gate receive and output signals can a gate produce? |
| 34. | Name six types of gates. |

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| 35. | | Compare and contrast the AND gate and the NOR gate. | |
| 36. | | Draw and label the symbol for a three input AND gate, then show its behavior with a truth table. | |
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| 37. | | Draw and label the symbol for a three-input OR gate, then show its behavior with a truth table. | |
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| 38. | How can gates be combined into circuits? | | | | | | | | | | |
| 39. | What are the two general categories of circuits and how do they differ? | | | | | | | | | | |
| 40. | Draw a circuit diagram corresponding to the following Boolean expression:  (A + B)(B + C) | | | | | | | | | | |
| 41. | Draw a circuit diagram corresponding to the following Boolean expression:  (AB + C)D | | | | | | | | | | |
| 42. | Draw a circuit diagram corresponding to the following Boolean expression:  A’B + (B+C)’ | | | | | | | | | | |
| 43. | Draw a circuit diagram corresponding to the following Boolean expression:  (AB)’ + (CD)’ | | | | | | | | | | |
| 44. | Show the behavior of the following circuit with a truth table: | | | | | | | | | | |
| **A** | | **B** | **AB** | **A+B** | **AB + (A+B)** | | | |
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| 45. | Show the behavior of the following circuit with a truth table: | | | | | | | | | | |
| **A** | | **B** | **A’** | **AB** | **A’** ⊕ **(AB)** | | | |
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| 46. | Show the behavior of the following circuit with a truth table: | | | | | | | | | | |
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| 47. | Show the behavior of the following circuit with a truth table: | | | | | | | | | | |
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